

TICKBORNE DISEASES IN MASSACHUSETTS

a physician's reference manual



Massachusetts Department of Public Health
Division of Epidemiology and Immunization
617.983.6800 www.state.ma.us/dph

TICK ID

DEER TICK *IXODES SCAPULARIS*



Adult female deer tick (CDC photo)



AMERICAN DOG TICK *DERMACENTOR VARIABILIS*



Adult female dog tick (CDC photo)



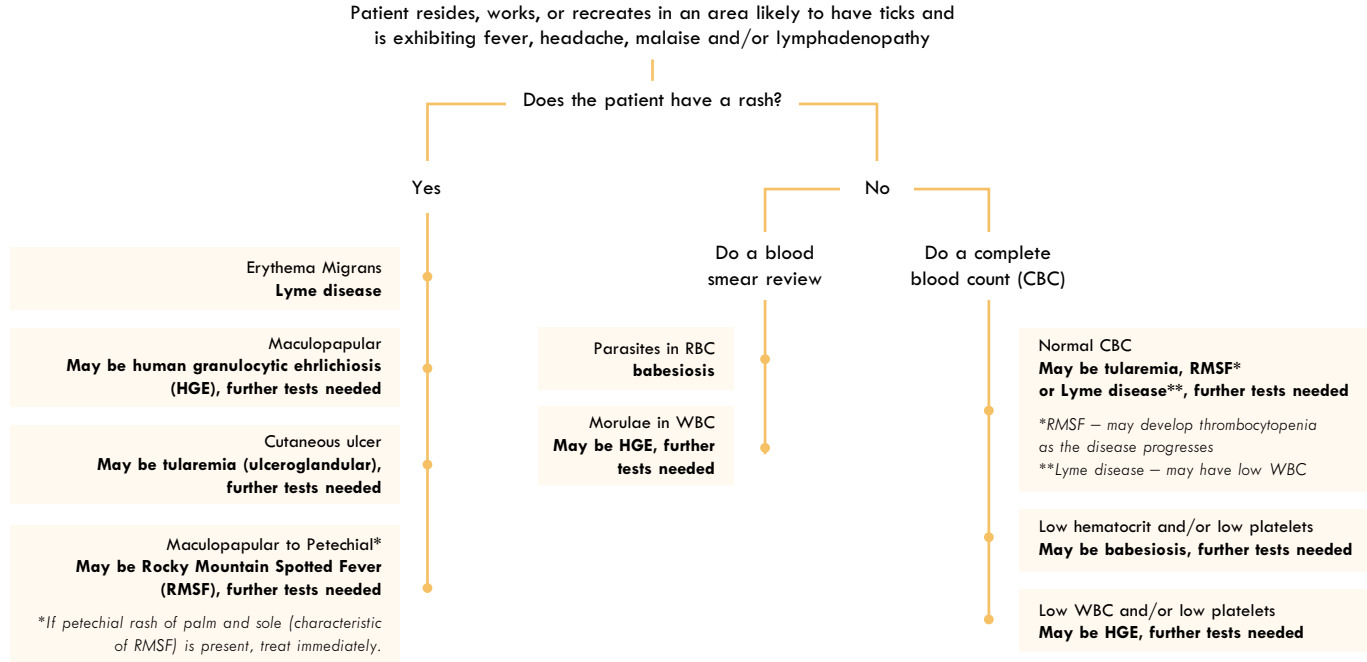
TICK FACTS

- The adult female deer tick has a reddish-brown tear-drop shaped body with a black dorsal shield. The adult female dog tick has a dark brown body with a whitish, patterned dorsal shield.
- Deer tick nymphs are the size of a poppy seed, and adult deer ticks are the size of a sesame seed. Adult dog ticks are the size of a watermelon seed.
- Ticks are generally found in brushy or wooded areas, near the ground.
- Ticks can be active at any temperature above freezing. The highest risk of exposure occurs during spring/summer for nymphs and summer/fall for adults.
- Ticks do not jump, fly, or drop from above. They attach to a host when the host brushes directly against them.

SUMMER FEVER ALGORITHM

ALGORITHM FOR DIFFERENTIATING BETWEEN TICKBORNE DISEASES IN MASSACHUSETTS

This algorithm should be used as a general guide when making clinical decisions, not to make a final diagnosis.



SUMMER FEVER ALGORITHM

OTHER CONSIDERATIONS

- Rash occurs 75-90% of the time with Lyme disease, 5-10% with HGE.
- Elevated liver function tests (LFT's): May be tularemia, Lyme disease, RMSF, or HGE, further tests needed.
- Bell's palsy presentation may be Lyme disease, further tests needed.
- Regional adenopathy? Look for a small ulceration distally. May be ulceroglandular tularemia, further tests needed.
- Coinfections with Lyme disease, babesiosis, and HGE may occur. The deer tick transmits all three diseases.
- RMSF is relatively rare and is transmitted via a dog tick bite or, rarely, when an infected dog tick is crushed or accidentally inoculated onto mucous membrane surfaces such as the conjunctiva.
- Tularemia is relatively rare and its clinical presentation will depend on how the bacteria are transmitted. Ulceroglandular or glandular tularemia is generally the result of a dog tick bite or direct contact with an infected animal. The bacteria can also be transmitted through the conjunctiva from contaminated fingers, splashes or aerosols (oculoglandular), via ingestion of water or meat that has been contaminated by an infected animal (pharyngeal), or by inhalation of contaminated particles (pneumonic).
- Physicians should consider pneumonic tularemia in any patient presenting with community-acquired pneumonia who resides on or has recently visited Martha's Vineyard.



LYME DISEASE

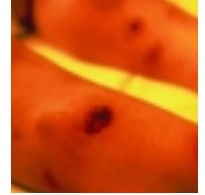


photo: www.lyme.org

AGENT

Bacteria: *Borrelia burgdorferi*

SIGNS/SYMPTOMS

LOCALIZED (WITHIN 3-30 DAYS)

- Erythema migrans (EM) — red ring-like or homogenous expanding rash
- May have flu-like symptoms

DISSEMINATED (WITHIN WEEKS TO MONTHS)

- Fatigue
- Malaise
- Lethargy
- Headache

DISSEMINATED (WITHIN WEEKS TO MONTHS) – CONTINUED

- Stiff neck
- Myalgia
- Arthralgia
- Regional or generalized lymphadenopathy
- Fever
- Erythema migrans (single or multiple lesions)

LATE OR CHRONIC (WITHIN MONTHS TO YEARS)

- Neurological – cranial neuritis, radiculoneuritis, lymphocytic meningitis, Bell's palsy
- Cardiac – carditis, heart block
- Arthritis – oligoarticular arthritis (usually the knee)



LYME DISEASE

FINDINGS FROM ROUTINE LABORATORY TESTS

- Elevated sedimentation rate (generally with localized or early disseminated disease)
- Mildly elevated hepatic transaminases (generally with localized or early disseminated disease)
- For cases of Lyme meningitis, CSF typically has a lymphocytic pleocytosis with slightly elevated protein levels and normal glucose levels

DIAGNOSTIC LABORATORY CRITERIA

- Demonstration of diagnostic IgM or IgG antibodies to *B. burgdorferi* in serum or cerebrospinal fluid. A two-tier testing protocol is recommended. A sensitive enzyme immunoassay (EIA) or immunofluorescence antibody (IFA) is completed first followed by a Western blot if the EIA or IFA is positive or equivocal, or
- Isolation of *B. burgdorferi* from a clinical specimen.

Note: Consider testing for babesiosis and HGE.

Note: Serologic tests should only be used to support a CLINICAL DIAGNOSIS of Lyme disease. Serologic testing is not recommended for patients diagnosed with Lyme disease because of an EM rash. Also, keep in mind when interpreting serologic test results:

Tests are not 100% sensitive or specific and are particularly insensitive in early Lyme disease. Tests cannot distinguish between active and past infection.

A false negative test may occur if done too early for a patient to mount an immune response or if a patient received antibiotics prior to testing.

A false positive test may occur if a patient is producing antibodies which cross react on the test, either for unknown reasons, or in response to a disease such as rheumatoid arthritis, infectious mononucleosis, systemic lupus erythematosus, spirochetal periodontal infections, relapsing fever, leptospirosis, Rocky Mountain spotted fever, or syphilis.



LYME DISEASE

Note: A therapeutic regimen appropriate to the clinical findings should be chosen. Some patients develop manifestations that may not resolve completely even after antibiotic treatment. A repeat course(s) of antibiotics may be necessary in some patients to alleviate symptoms.

Note: The suggested regimens below may differ depending on a patient's age, medical history, underlying health conditions, pregnancy status, or allergies. These regimens were current as of the publication of this manual; however, treatment regimens change with time. Consult an infectious disease specialist for the most current treatment guidelines or for individual patient treatment decisions.

EARLY INFECTION (LOCAL OR DISSEMINATED)

| <i>patient</i> | <i>suggested regimen*</i> |
|----------------|--|
| Adults | Doxycycline, 100 mg orally twice daily for 14-21 days, or Amoxicillin, 500 mg orally three times daily for 14-21 days, or Cefuroxime axetil, 500 mg orally twice daily for 14-21 days |
| Children | Doxycycline, (children 8 years or older) 1-2 mg/kg orally twice daily for 14-21 days (max 100 mg/dose), or Amoxicillin, 50 mg/kg/day orally divided into three doses for 14-21 days (max 500 mg/dose), or Cefuroxime axetil, 30 mg/kg/day divided into two doses orally for 14-21 days (max 500 mg/dose) |

ARTHRITIS

| <i>patient</i> | <i>suggested regimen*</i> |
|----------------|--|
| Adults | Doxycycline, 100 mg orally twice daily for 28 days, or Amoxicillin, 500 mg orally three times daily for 28 days, or Cefuroxime axetil, 500 mg orally twice daily for 28 days |

ARTHRITIS — CONTINUED

| <i>patient</i> | <i>suggested regimen*</i> |
|----------------|---|
| Children | Doxycycline, (children 8 years or older) 1-2 mg/kg orally twice daily for 28 days (max 100 mg/dose), or Amoxicillin, 50 mg/kg/day orally divided into three doses for 28 days (max 500 mg/dose), or Cefuroxime axetil, 30 mg/kg/day divided into two doses orally for 28 days (max 500 mg/dose) |

RECURRENT ARTHRITIS AFTER ORAL REGIMEN

Note: The penicillin dosage should be reduced for patients with impaired renal function.

| <i>patient</i> | <i>suggested regimen*</i> |
|----------------|---|
| Adults | Repeat arthritis oral regimen, or Ceftriaxone, 2 g IV once daily for 14-28 days, or Cefotaxime, 2 g IV three times a day for 14-28 days, or Penicillin G, 18-24 million units a day IV divided into doses given every 4 hours for 14-28 days |
| Children | Repeat arthritis oral regimen, or Ceftriaxone, 75-100 mg/kg/day IV in a single dose for 14-28 days (max 2 g), or Cefotaxime, 150-200 mg/kg/day IV divided into 3 or 4 doses for 14-28 days (max 6 g/day), or Penicillin G, 200,000-400,000 units/kg/day, IV divided into doses given every four hours for 14-28 days (max 18-24 million units/day) |



LYME DISEASE

NEUROLOGIC ABNORMALITIES

FACIAL NERVE PALSY

| <i>patient</i> | <i>suggested regimen*</i> |
|----------------|---|
| Adults | See adult oral regimens under Early Infection Guidelines |
| Children | See children oral regimens under Early Infection Guidelines |

MORE SERIOUS CNS DISEASE

Note: The penicillin dosage should be reduced for patients with impaired renal function.

| <i>patient</i> | <i>suggested regimen*</i> |
|----------------|--|
| Adults | Ceftriaxone, 2 g IV once daily for 14-28 days, or Cefotaxime, 2 g IV three times a day for 14-28 days, or Penicillin G, 18-24 million units a day IV divided into doses given every 4 hours for 14-28 days |
| Children | Ceftriaxone, 75-100 mg/kg/day IV in a single dose for 14-28 days (max 2 g), or Cefotaxime, 150-200 mg/kg/day IV divided into 3 or 4 doses for 14-28 days (max 6 g/day), or Penicillin G, 200,000-400,000 units/kg/day, IV divided into doses given every four hours for 14-28 days (max 18-24 million units/day) |

CARDIAC ABNORMALITIES

FIRST DEGREE AV BLOCK OR SECOND DEGREE AV BLOCK

| <i>patient</i> | <i>suggested regimen*</i> |
|----------------|---|
| Adults | See adult oral regimens under Early Infection Guidelines |
| Children | See children oral regimens under Early Infection Guidelines |

THIRD DEGREE AV BLOCK

Note: A temporary pacemaker may be required.

Note: The penicillin dosage should be reduced for patients with impaired renal function.

| <i>patient</i> | <i>suggested regimen*</i> |
|----------------|--|
| Adults | Ceftriaxone, 2 g IV once daily for 14-21 days, or Cefotaxime, 2 g IV three times a day for 14-21 days, or Penicillin G, 18-24 million units a day IV divided into doses given every 4 hours for 14-21 days |
| Children | Ceftriaxone, 75-100 mg/kg/day IV in a single dose for 14-21 days (max 2 g), or Cefotaxime, 150-200 mg/kg/day IV divided into 3 or 4 doses for 14-21 days (max 6 g/day), or Penicillin G, 200,000-400,000 units/kg/day, IV divided into doses given every four hours for 14-21 days (max 18-24 million units/day) |

* Wormser GP., Nadelman RB., Dattwyler RJ., Dennis DT., Shapiro ED., Steere AC., Rush TJ., Rahn DW., Coyle PK., Persing DH., Fish D., Luft BJ. Practice Guidelines for the Treatment of Lyme Disease. Guidelines from the Infectious Disease Society of America. Clinical Infectious Diseases. 2000; 31 (Suppl 1): S1-14.



BABESIOSIS

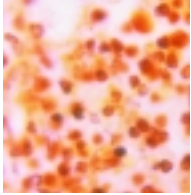


photo: www.lyme.org

AGENT

Parasite: *Babesia microti*

SIGNS/SYMPTOMS

- Generalized weakness
- Fever, chills
- Gastrointestinal symptoms: anorexia, nausea, abdominal pain, vomiting, diarrhea
- Headache
- Myalgia
- Weight loss
- Arthralgia
- Respiratory symptoms: cough, shortness of breath — In severe cases, adult respiratory distress syndrome

SIGNS/SYMPTOMS – CONTINUED

- Dark urine, jaundice
- Petechiae, ecchymoses
- Splenomegaly

FINDINGS FROM ROUTINE LABORATORY TESTS

- Hemolytic anemia
- Thrombocytopenia
- Mild leukopenia
- Elevated erythrocyte sedimentation rate
- Elevated alkaline phosphatase and transaminases

DIAGNOSTIC LABORATORY CRITERIA

- Identification of intraerythrocytic *Babesia* parasites by light microscopy in a peripheral blood smear, or
- Isolation of the parasite from a whole blood specimen by animal inoculation.
- Demonstration of a *Babesia*-specific antibody titer of at least 1:256 with an indirect fluorescent antibody test (IFA) for total Ig or IgG is supportive of the diagnosis.

Note: Consider testing for Lyme disease and HGE.



BABESIOSIS

Note: The suggested regimens below may differ depending on a patient's age, medical history, underlying health conditions, pregnancy status, or allergies. These regimens were current as of the publication of this manual; however, treatment regimens change with time. Consult an infectious disease specialist for the most current treatment guidelines or for individual patient treatment decisions.

MILD SYMPTOMS

PATIENTS CAN RECOVER WITH NO TREATMENT

| <i>patient</i> | <i>suggested regimen*</i> |
|----------------|---|
| Adults | Atovaquone, 750 mg orally twice a day for 7-10 days plus azithromycin, 600 mg orally daily for 7-10 days, or Clindamycin, 1.2 g IV twice a day or 600 mg orally three times a day for 7-10 days plus quinine, 650 mg orally three times a day for 7 days |
| Children | Atovaquone, 20 mg/kg orally twice a day for 7-10 days plus azithromycin, 12 mg/kg orally daily for 7-10 days, or Clindamycin, 20-40 mg/kg/day, orally in three doses for 7 days plus quinine, 25 mg/kg/day orally in three doses for 7 days |

Note: Severely ill patients with high parasitemia and asplenic patients with life-threatening illness should be considered for exchange transfusion.

*Medical Letter Advisory Board. Drugs for Parasitic Infections. The Medical Letter. April, 2002.



HUMAN GRANULOCYTIC EHRLICHIOSIS (HGE)

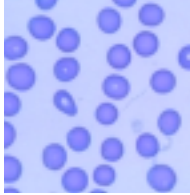


photo: www.lyme.org

AGENT

Bacteria: *Anaplasma phagocytophila* (formerly in the genus *Ehrlichia*)

SIGNS/SYMPTOMS

- Fever, chills, rigors
- Severe headache
- Malaise
- Myalgias
- Anorexia
- Nausea
- Vomiting
- Cough, arthralgia, dyspnea, and confusion are less commonly noted
- Rash is rare

FINDINGS FROM ROUTINE LABORATORY TESTS

- Leukopenia, particularly neutropenia — during the first week of illness
- Thrombocytopenia — during the first week of illness
- Anemia, less frequently — during the first week of illness
- Lymphocytosis — during the second week of illness
- Mild to moderate elevations in hepatic transaminases
- Elevated plasma creatinine

DIAGNOSTIC LABORATORY CRITERIA

- Demonstration of a four-fold change in antibody titer by IFA in paired sera, or
- Positive PCR, or
- Visualization of morulae in leukocytes and a single positive IFA result, based on cutoff titers established by the laboratory performing the assay (either is supportive of the diagnosis), or
- Immunostaining of *A. phagocytophila* in a biopsy or autopsy specimen, or
- Culture of *A. phagocytophila*.

Note: Consider testing for Lyme disease and babesiosis.



HUMAN GRANULOCYTIC EHRLICHIOSIS (HGE)

Note: The suggested regimens below may differ depending on a patient's age, medical history, underlying health conditions, pregnancy status, or allergies. These regimens were current as of the publication of this manual; however, treatment regimens change with time. Consult an infectious disease specialist for the most current treatment guidelines or for individual patient treatment decisions.

| <i>patient</i> | <i>suggested regimen*</i> |
|----------------------------|--|
| Adults | Tetracycline, 25 mg/kg/day in four divided doses orally for 14 days, or Doxycycline, 100 mg two times a day intravenously or orally for 14 days |
| Children 8 years and older | |
| – Weight: 45 kg or more | Doxycycline, 100 mg two times a day intravenously or orally for 14 days |
| – Weight: less than 45 kg | Doxycycline, 3 mg/kg every 12 hours intravenously or orally for 14 days |
| Children under 8 years | Consult a pediatric infectious disease physician |

Note: Response to treatment usually is apparent within 24–48 hours.

* Olano JP., Walker DH. Human Ehrlichiosis. Medical Clinics of North America. 2002; 86(2): 375-392.



TULAREMIA



AGENT

Bacteria: *Francisella tularensis* (formerly *Pasteurella tularensis*)

SIGNS/SYMPTOMS

- Cutaneous ulcer (ulceroglandular form)
- Inguinal or axillary lymphadenopathy (ulceroglandular or glandular form)
- Regional lymphadenopathy with conjunctivitis (oculoglandular form)
- Headache
- Myalgia
- Fever, chills
- Weight loss
- Arthralgia
- Regional lymphadenopathy with pharyngitis (pharyngeal form)
- Abdominal pain, diarrhea, vomiting (typhoidal form)

SIGNS/SYMPTOMS – CONTINUED

- Chest discomfort, shortness of breath (pneumonic form)
- Pulmonary infiltrates (pneumonic form)

FINDINGS FROM ROUTINE LABORATORY TESTS

- Leukocyte count and sedimentation rate may be normal or elevated
- Thrombocytopenia
- Hyponatremia
- Elevated serum transaminases
- Elevated creatine phosphokinase
- Myoglobinuria
- Sterile pyuria

DIAGNOSTIC LABORATORY CRITERIA

- Four-fold or greater change in serum antibody titer to *F. tularensis* antigen (the acute specimen should be taken at least seven days after the onset of symptoms and the convalescent specimen taken 2-3 weeks after the acute specimen), or
- Isolation of *F. tularensis* in a clinical specimen.
- Detection of *F. tularensis* in a clinical specimen by fluorescent assay or a single antibody titer of 1:160 or higher is supportive of the diagnosis.



TULAREMIA

Note: The suggested regimens below may differ depending on a patient's age, medical history, underlying health conditions, pregnancy status, or allergies. These regimens were current as of the publication of this manual; however, treatment regimens change with time. Consult an infectious disease specialist for the most current treatment guidelines or for individual patient treatment decisions.

| patient | suggested regimen* |
|---------|--|
| Adults | Gentamicin, 5 mg/kg IM or IV once daily for 10 days, with desired peak serum levels of at least 5.0 ug/ml, or Streptomycin, 1 g IM twice daily for 10 days (add chloramphenicol 50-100 mg/kg/day IV in 4 divided doses for 7-14 days if meningitis), or Doxycycline, 100 mg IV twice daily for 14-21 days, or Chloramphenicol, 15 mg/kg IV four times daily for 14-21 days, or Ciprofloxacin, 400 mg IV twice daily for 10 days |

Children Gentamicin, 2.5 mg/kg IM or IV three times daily for 10 days, or
Streptomycin, 15 mg/kg IM twice daily for 10 days
(maximum dose 2 g/day), or
Doxycycline
– Weight: 45 kg or more
100 mg IV twice daily for 14-21 days
– Weight: less than 45 kg
2.2 mg/kg IV twice daily for 14-21 days, or
Chloramphenicol, 15 mg/kg IV four times daily for 14-21 days, or
Ciprofloxacin, 15 mg/kg IV twice daily for 10 days
(maximum dose 1 g/day)

Note: Tetracycline treatment is effective, but associated with significant relapse rates.

Note: Doxycycline has a much higher relapse rate compared with the aminoglycosides.

Note: Doses of both streptomycin and gentamicin need to be adjusted for renal insufficiency.

Note: Short courses of fluoroquinolones have not been associated with arthropathy in pediatric patients, and the potential risks of their use must be weighed against their benefits in treating serious infections.

* Dennis D., Inglesby TV., Henderson DA., et. al. Tularemia as a Biological Weapon: Medical and Public Health Management. Journal of the American Medical Association. 2001. 285(21): 2763-2773.

Adding chloramphenicol if meningitis reference: Cross JT., Penn RL. (2000). Chapter 216: Francisella tularensis (Tularemia). In Mandell GL., Bennett JE., Dolin R. Principles and Practices of Infectious Diseases. 5th edition. Volume two: (page 2400). Philadelphia: Churchill Livingstone.



ROCKY MOUNTAIN SPOTTED FEVER (RMSF)

AGENT

Bacteria: *Rickettsia rickettsii*

SIGNS/SYMPTOMS

- Fever, chills
- Severe headache
- Maculopapular rash, usually first appearing 3-5 days after fever starts, on the extremities and then spreading to most of the body (including the palms and soles), 10-20% of cases do not get a rash
- Petechial exanthem, in 40-60% of cases, generally on or after the 6th day of illness
- Abdominal pain (prominent in some, especially children)
- Nausea, vomiting, diarrhea
- Anorexia
- Myalgia
- Malaise
- Confusion
- Thirst (excessive)
- Photosensitivity
- Conjunctival injection
- Hallucinations (rarely)



FINDINGS FROM ROUTINE LABORATORY TESTS

- Thrombocytopenia
- Elevated serum transaminase levels
- Anemia
- Hyponatremia
- Azotemia
- Renal insufficiency, elevated creatinine

DIAGNOSTIC LABORATORY CRITERIA

Note: Treatment decisions should be based on epidemiologic and clinical indicators, and should never be delayed for confirmation by laboratory results.

- Four-fold or greater rise in antibody titer to *R. rickettsii* antigen by immunofluorescence antibody (IFA), complement fixation (CF), latex agglutination (LA), microagglutination (MA) or indirect hemagglutination antibody (IHA) test in acute- and convalescent-phase specimens ideally taken at least 3 weeks apart, or
- Positive polymerase chain reaction (PCR) assay to *R. rickettsii*, or
- Demonstration of positive immunofluorescence of skin lesion (biopsy) or organ tissue (autopsy), or
- Isolation of *R. rickettsii* from a clinical specimen
- A single IFA serologic titer of at least 1:64 or CF titer of at least 1:16 is supportive of the diagnosis.



ROCKY MOUNTAIN SPOTTED FEVER (RMSF)

Note: The suggested regimens below may differ depending on a patient's age, medical history, underlying health conditions, pregnancy status, or allergies. These regimens were current as of the publication of this manual; however, treatment regimens change with time. Consult an infectious disease specialist for the most current treatment guidelines or for individual patient treatment decisions.

| <i>patient</i> | <i>suggested regimen*</i> |
|----------------|---|
| Adults | Doxycycline, 200 mg per day oral or IV in two divided doses for 7 days, continuing for 2 days after the patient becomes afebrile (IV treatment is recommended for patients experiencing vomiting or nausea and for those who are seriously ill), or Chloramphenicol, 50 to 75 mg/kg/day IV given in 4 divided doses for 7 days, continuing for 2 days after the patient becomes afebrile |

Children

- Weight: 45 kg or more
Doxycycline, use the adult dose for 7 days, continuing for 2 days after the patient becomes afebrile
- Weight: Less than 45 kg
Doxycycline, 2-4 mg/kg/day oral or IV in 1-2 divided doses for 7 days, continuing for 2 days after the patient becomes afebrile

Note: Although tetracyclines are generally avoided in young children because of concerns for staining of teeth, it is recommended that doxycycline be used for suspected RMSF in children because of the life-threatening nature of the disease and the low likelihood that a single course of doxycycline would stain the teeth.

* Adults: Walker D., Raoult D. (2000). Chapter 175: Rickettsia Rickettsii and Other Spotted Fever Group Rickettsiae. In Mandell GL, Bennett JE, Dolin R. Principles and Practices of Infectious Diseases. 5th edition. Volume two: (page 2039). Philadelphia: Churchill Livingstone.

Children: American Academy of Pediatrics. [Rocky Mountain Spotted Fever]. In: Pickering LK, ed. 2000 Red Book: Report of the Committee on Infectious Diseases. 25th edition. Elk Grove Village, IL: American Academy of Pediatrics; 2000: [491-493, 662].

IMPORTANT RESOURCES

For more information on tickborne diseases, call the Massachusetts Department of Public Health (MDPH), Division of Epidemiology and Immunization at 617-983-6800 or visit the MDPH web site at www.state.ma.us/dph or the Centers for Disease Control and Prevention (CDC) web site at www.cdc.gov.

For information on Western blot assays for Lyme disease performed by MDPH, call the State Laboratory Institute at 617-983-6396.

To report a case of tickborne disease, contact your local Board of Health or call the MDPH Surveillance Program at 617-983-6801. They will send you a case report form, which, once completed, can be sent via confidential fax to the MDPH Surveillance Program at 617-983-6813.

For information on the number and types of tickborne diseases reported in your area, contact your local Board of Health or call the MDPH Division of Epidemiology and Immunization at 617-983-6800.

April, 2003



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